Remarks

Claims 1, 2 and 4-24 are pending in this application. Claims 3 and 25 have been canceled without prejudice and claims 1 and 14 are amended. No new matter has been added as a result of the above amendments. Furthermore, Applicant wishes to thank Examiners Duong and Chowdhury for the telephone interview granted his attorneys on February 19, 2004. Although no definite allowance of the claims was agreed upon, the exact content of the Interview Summary does not fully reflect the fact that there are major differences between the present claimed invention and Yamada et al. In order to expedite the allowance of this application, Applicant agreed to file an RCE together with a Declaration under 37 CFR 1.132 and have done so.

Rejection of claims 1, 2, 4-6 and 14-17 are rejected under 35 USC 102(b)

Claims 1, 2, 4-6 and 14-17 are rejected under 35 USC 102(b) as being anticipated by Yamada *et al.* (US 5,668,651). Applicant respectfully disagrees.

The Examiner states, in Summary, that Yamada discloses a method for fabricating a liquid crystal display comprising providing a nematic liquid crystal and a photo-curable pre-polymer mixture, mixing the nematic liquid crystal with the photo-curable pre-polymer mixture to form a homogeneous nematic/pre-polymer mixture; providing a cell having a pair of spaced apart transparent substrates coated with a transparent conductive layer; filling the cell with the homogeneous mixture and photocuring the mixture using a spatially inhomogeneous illumination source.

Section 102 of Title 35 provides the novelty requirements for patentability. In order for a prior art reference to anticipate a claim it must teach each and every element of that claim. M.P.E.P. §2131. The Court of Appeals for the Federal Circuit states:"[a] claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628 (CAFC, 1987).

The presently claimed invention (claims 1 and 14 being exemplary) provides a method of fabricating an optical device by providing a nematic liquid crystal formed from an eutectic mixture; providing a photo-curable pre-polymer mixture; mixing the nematic liquid crystal with the photo-curable pre-polymer mixture to form a homogeneous nematic/pre-polymer mixture, with the nematic liquid crystal representing greater than 40% (by weight) of the combined homogeneous mixture; and providing a cell including a pair of transparent substrates that are each coated with a transparent conductive layer when creating an electrooptic device and omitting the conductive layers when creating a static device. Further, in selected dependent claims the invention includes the steps of: separating the substrates by approximately 5-6 to about 8-20 μm; filling the cell with the homogeneous nematic/pre-polymer mixture; and photo-curing the nematic/pre-polymer mixture using a spatially inhomogeneous illumination source thereby forming a polymer dispersed liquid crystal (PDLC) film exhibiting low scattering loss and high index modulation.

There are significant distinctions between the art in Yamada (US 6,339,486) and the presently claimed invention. In order to better understand why Yamada fails to meet Applicant's claimed limitations, it is preferable to understand the distinct overall differences between Yamada and the present invention. First, Yamada is directed toward a display device, while the present invention is not (as far as display is understood with respect to Yamada). Other significant differences exist. For example, the nematic liquid crystal content in Yamada's displays is aligned via two mechanisms: (1) alignment layers (15 & 17 in Figs. 1A, B) on the substrates and (2) either an electric or magnetic field applied to the display during photo-curing the micrometer-scale bulk photo-polymer walls. In contrast to Yamada, alignment in the present invention is achieved via fluid flow on a nanometer-scale. Thus, the material system in Applicant's claimed invention creates a polymer dispersed liquid crystal or PDLC, while the material in Yamada is not. Moreover, the photo-polymer content in Yamada contains photo-polymerizable nematics, while the photo-polymer content in the present invention does not due to the materials used. Further, light traversing Yamada's displays passes through bulk nematic layers only, while in the devices of the present invention, light passes through many photo-polymer/nematic interfaces (see Figs. 2c and 3 of the present application). Yamada's displays offer low contrast switching with relatively high

scattering loss, while the transmissive PDLC devices in the present invention as claimed, contrary to Yamada, achieve high contrast and low scattering loss.

The Examiner states "providing a nematic liquid crystal" is covered by Yamada 14:47-53 (column:lines). Yamada states chiral nematics or cholesteric LCs are preferred; however, the present invention prefers non-chiral nematics based on experimental data, in direct contrast with Yamada.

The Examiner also states "mixing said nematic liquid crystal with said photo-curable pre-polymer mixture to form a homogeneous nematic/pre-polymer mixture, with said nematic liquid crystal being greater than 40%(by weight) of said combined homogeneous mixture" is covered by Yamada 12:30-37 and 15:53-56. However, Yamada teaches away from what is presently claimed. For example, col. 15, ln. 56-63 state that "[i]f the liquid crystal material accounts for less than 50% by weight ... the polymer wall matrix exercises excessive influence ... thereby ruining practicality of the ... device." Clearly, Yamada is teaching away from what is presently claimed.

The Examiner also states "filling said cell with said homogeneous nematic/pre-polymer mixture" is covered by Yamada 9:18-21. In actuality, Yamada "injects" the LC mixture into a cell that has substrates with an "orientation treatment." The devices of the presently claimed invention do not require any alignment treatment on the substrates.

The Examiner states "photo-curing said nematic/pre-polymer mixture using a spatially inhomogeneous illumination source thereby creating the electrooptic device in the form of a polymer dispersed liquid crystal (PDLC) exhibiting low scattering loss and high index modulation" is covered by Yamada 9:61-10:17 and 15:11-30. In actuality, Yamada uses spatially inhomogeneous UV radiation to "effect a photo-polymerization" at "a temperature equal to or higher than the homogenization temperature of the [polymer/liquid crystal] mixture," as described in 9:61-10:3. In contrast, the photo-polymerization process of the present invention does not take place at elevated temperature, in fact, under elevated temperatures the present invention would not work - for example, the gratings would be lost and drift would be experienced. Additionally, the present invention does not utilize an

electric or magnetic field during photo-curing, as Yamada does by necessity, as stipulated in 9:18-27 and 9:46-52 and in method claims 9, 17, and 18. Further, Yamada describes the contrast of his displays in simple scalar terms in 15:11-30. As demonstrated by Applicant, a proper description of contrast for diffractive and non-dispersive PDLC optical devices requires a tensor approach. (See US Application 20020097355.)

The Examiner sets forth, "wherein said nematic liquid crystal possesses a positive dielectric anisotropy" is covered by Yamada 13:54-59. In contrast thereto, the Yamada reference to positive dielectric anisotropy nematic liquid crystals is actually referring to the liquid crystal polymerizable constituents in his mixtures – see 12:29-14:17. The present invention does not use polymerizable nematic material.

The Examiner further states, "wherein said substrates are separated by approximately 7 micrometers" is covered by Yamada 20:63-65. Actually, the modifier "approximately" doesn't appear in Yamada. To quote, "The substrates were attached to each other, and spacers having a particle size of 7 μm were injected ..." The invention as set forth in claim 4 specifies the following, "The method as defined in claim 1 wherein said substrates are separated by approximately 5-20 μm." The claim as amended now claims substrates separated from about 5-6 μm to about 8-20 μm.

The Examiner states that "the modifier 'approximately' for spacing the two substrates is appropriate since ... the size of the spacers injected between the two substrates is 7 micrometers." Applicant is perplexed by such a non-logical argument. What is clear is that Yamada specifically stated 7 micrometers, he did not state approximately, or about, or anything equivalent. Therefore, he is precluded from extending spacing to lower than 7 or greater than 7.

The Examiner recites "wherein said PDLC is comprised of a dispersion of discrete droplets containing nematic liquid crystal-rich material in a polymer-rich matrix" and "wherein said PDLC is comprised of inter-connected spaces that are filled with nematic liquid crystal-rich material" are covered by Yamada Figs. 1A and 1B. As pointed out above, Yamada's displays schematically depicted in his Figs. 1A and 1B are significantly different than the presently claimed invention's optical devices in several aspects. For example,

Yamada uses alignment layers 15 and 17, the present invention does not; also, Yamada uses a polymerizable nematic in the polymer regions, the present invention does not; also, Yamada prefers chiral nematic, cholesteric, or negative dielectric anisotropy nematic constituents, while the clear preference in the instant invention are positive dielectric anisotropy nematics for the electro-active constituents; finally, Yamada uses bulk nematic liquid crystals, while the presently claimed invention employes PDLC materials.

The Examiner contends that claim 14 of the present invention – a claimed method for covering static PDLC optical components – is covered by Popovich in US Patent 6,339,486B1, 17:52-18:10; however, Popovich describes static optical components that are not PDLC materials. In fact, the static components described in Popovich do not even contain nematic liquid crystals: an ingredient in the presently claimed invention's static devices.

Clearly, the "each and every element" rule articulated above has not been satisfied and therefore, the references cited by the Examiner fails to defeat novelty for the presently claimed invention. Therefore, Applicant respectfully requests reconsideration and withdrawal of the present rejection.

Furthermore, even if the Examiner relies upon a 35 USC 103 rejection of claims 1, 2, 4-6 and 14-17 in view of Yamada, such a rejection would be in error in view of the many significant differences that exist between the presently claimed invention and that disclosed in Yamada.

Rejection of claims 7-9 and 18-20 under 35 USC 103(a)

Claims 7-9 and 18-20 are rejected under 35 USC 103(a) as being unpatentable over Yamada *et al.* (US 5,668,651) in view of Sumiyoshi *et al.* (US 6,278,506). Applicant respectfully disagrees.

The Examiner states that "Yamada *et al.* disclose a method of fabricating a liquid crystal device that is basically the same as that recited in claims 7-9 and 18-20 except for the step of deriving said spatially inhomogenous illumination source used to photo-cure the

nematic/prepolymer mixture from the interference of two coherent optical beams within said cell." *Office Action, pg. 4, dated May 23, 2003.* The Examiner continues, "Sumiyoshi *et al.* disclose a method of fabricating a liquid crystal cell (Fig. 5A) comprising the step of deriving a spatially inhomogenous illumination source 16 used to photo-cure a nematic/pre-polymer mixture 15a ...

In order to establish a *prima facie* case of obviousness, "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references) must teach or suggest all of the claim limitations." M.P.E.P. §2143, see also, *In re* Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Moreover, it is axiomatic in patent law that if an independent claim defines allowable subject matter then the claims depending therefrom also define allowable subject matter. *In re* Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988), and Hartness International, Inc. v. Simplimatic Engineering Co., 819 F.2d 1100, 1108, 2 USPQ2d 1826, 1831 (Fed. Cir. 1987). Given that the rejected claims depend from base claims and those independent claims define allowable subject matter, then the claims at issue must necessarily define allowable subject matter. The reasons for allowability of the base claims are set forth above.

The Examiner says "Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the method of fabricating a LCD device of Yamada *et al.* with the teaching of Sumiyoshi *et al.* by employing two interfering optical beams which are incident symmetrically about a direction normal to said cell in order to form said PDLC as an unslanted PDLC transmission grating so as to produce a highly bright image for the display."

The assertion that the displays of Yamada could be made using two coherent interfering UV beams according to the teaching of Sumiyoshi is inaccurate. First, consider that Yamada never mentions the use of holographic fabrication techniques in his disclosure. This is not by oversight, but rather, by design and of necessity. Consider Yamada's

exposition on the production method of his art in a lengthy section entitled "Production method," found in 9:10-10:17, specifically 9:28-38 where Yamada describes the UV radiation distribution as having "weakly irradiated regions" (quotes by Yamada) that he defines as those regions "not irradiated with UV-rays" (Yamada, 9:34-35). Thus, when Yamada says, "weakly irradiated," he by his own definition means not irradiated. Holographic irradiation distributions can never produce such idealized, sharp spatial features, but rather, smooth, sinusoidally-varying spatial distributions. Strictly speaking, a holographic exposure formed by the interference of two coherent optical beams does not allow for 2-dimensional regions with zero optical (UV) radiation, as required by Yamada. Yamada appreciated this and hence never allowed for holographic production methods in his invention.

Moreover, there is no teaching, suggestion, nor motivation provided by either reference to combine. Additionally, there is no evidence suggesting that were these two references combined the result would be Applicant's claimed invention. A case of *prima facie* obviousness has not been established and therefore Applicant respectfully requests reconsideration and withdrawal of the present rejection.

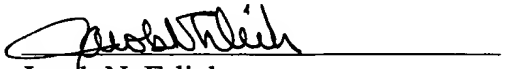
Applicant has also included herewith a Declaration under 37 CFR 1.132 by John C. Kralik.

In conclusion, in view of the above amendments and remarks, Applicant respectfully requests the Examiner find claims 1, 2 and 4-24 allowable over the prior art and issue a Notice of Allowance.

Please charge the RCE fee of $770.00 along with any underpayment of fees, or credit any overpayment of fees, to Deposit Account No. 50-1078.

The Examiner is invited to call the undersigned attorney at (617) 854-4000 should he determine that a telephonic interview would expedite prosecution of this case.

Respectfully submitted,
John C. Kralik, Applicant



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